

Abstract

In this thesis, a new Green's function Monte Carlo (GFMC) algorithm for the one-dimensional Helmholtz equation subject to Neumann and mixed boundary conditions has been developed. Traditional Monte Carlo algorithms for mixed boundary condition problems have involved “reflecting boundaries” resulting in relatively large computational costs. In the last few years however, a radically new approach has been proposed by my advisor, Prof. Kausik Chatterjee, which eliminates the use of reflecting boundary conditions through the introduction of novel Green's functions that mimic the boundary conditions of the problem of interest. The methodology has already been validated by analytical benchmark problems involving the one-dimensional Laplace's equation and the modified Helmholtz equation. My current work involves the extension of the methodology to the Monte Carlo solution of the one-dimensional Helmholtz equation. The methodology is however constrained to quarter-wavelength length scales because of the nature of the Green's function used. This restriction is also present for Dirichlet problems and is not specific to Neumann and mixed boundary condition problems. However, within that constraint, excellent agreement has been obtained between analytical solutions and numerical results.